SCIENCE.

FRIDAY, DECEMBER 12, 1884.

COMMENT AND CRITICISM.

THE QUESTION of manual training is beginning to receive in this country the attention it deserves. Among the indications of this fact, we point to the experiments which are in progress in New York, Philadelphia, St. Louis, Chicago, Baltimore, and other important cities; to the admirable debate (never, we believe, adequately reported) which occurred in the section of mechanics at the Philadelphia meeting of the American association; to the report presented to congress a year or more ago on technical education, by Gen. Eaton, the U. S. commissioner; to the interest which has been awakened by the British-commission report on the same subject, of which three volumes have appeared; and, finally, to the action of the Slater trustees in insisting that the income which they distribute among the schools for freedmen shall only be given to schools where manual labor or handicraft is encouraged.

Some light is thrown upon principles and methods by a recent paper on technical education, by David Sandeman and E. M. Dixon of Glasgow. They discuss the relations of the elementary school and the work-shop; second, the part which secondary schools may take in preparing boys for industrial pursuits; third, the sphere of school work-shops or technical schools. Their conclusions, which are of general interest, though intended only for Scotland, are briefly stated, as follows: Every child should have as good a general education as he can get; as circumstances differ, schools must be adapted to different wants of the industrial classes; there should be elementary schools for children less than thirteen years old, secondary schools for more who can continue to study until they are sixteen; and, in both, school work-shops should be established; apprenticeships might thus be reduced in time; finally, trades should be taught systematically to the young, after they leave school, either in a work-shop or in a special building detached from a work-shop, as experience may suggest.

AN ARGUMENT which did good duty during the dark ages, but which has fallen into disuse in later times, has seldom been more *naïvely* employed than in the following passage, taken from a little book just published, 'On the discovery of the periodic law:' —

> "Are the atomic weights invariable? This question must most probably be answered in the affirmative. If the atomic weight of an element varies, such variation is most likely very slight, otherwise the simple relation between the atomic weights of the elements when arranged in their natural order would be liable to be disturbed."

Mr. Newlands (late professor of chemistry in the City of London college), who is the author of the above passage, is also a claimant to the honor of having discovered Mendelejew's periodic law. How far chemists were from suspecting the truth of that law in 1866, appears from the fact, that, at a meeting of the Chemical society, Prof. G. F. Foster humorously inquired of Mr. Newlands whether he had ever examined the elements according to the order of their initial letters.

HOW MUCH brighter is sun than moon? Can anybody tell? Has anybody tried to tell? What shall be the standard of measurement? Sir William Thomson has lately printed a note which conveys some curious data bearing on these questions. During the meeting of the British association at York in 1881, he observed the moon when it was nearly full, and at about midnight. He found the light to be equal to that of a candle at a distance of two hundred and thirty centimetres. Making no account of the loss of moonlight in transmis-

sion through the earth's atmosphere, he computed that twenty-seven thousand million million candles must be spread over the moon's earthward hemisphere, painted black, to send us as much light as we receive from her. Probably forty thousand million million candles would be required to allow for absorption. Sir William carried his computations a little farther, and figured, that, if the face of the moon which we see were painted black, and covered with candles standing packed in square order, touching one another, all burning normally, the light received at the earth would be about the same in quantity (as estimated by our eyes) as it really is.

How does moonlight compare with sunlight? On the 8th of December, 1882, Sir William Thomson in Glasgow measured the brilliancy of the sunlight at one P.M., and computed that it was about fifty-three thousand times greater than that of a candle-flame. This, he says, is more than three times the value found by Arago for the intensity of the sun's light. 'So much for a Glasgow December sun!' Hence he derived the conclusions that the Glasgow sunlight was seventy-one thousand times the York moonlight, and that "we cannot be *very far* wrong in estimating the light of full moon as about a seventy-thousandth of the sunlight anywhere on the earth." Those who are curious to know more of this inquiry will find the note to which we call attention in the proceedings of the Glasgow philosophical society for 1882–83.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The oldest living type of vertebrates.

I was gratified to have my own conclusions as to the systematic relations of the galeoid Selachians verified by so competent an original investigator as Mr. Garman. The differences between us now are fictitious rather than real; or better, perhaps, they are chiefly differences of expression.

As to the characters of the Opistharthri, it must be remembered that I assigned them long before Chlamydoselachus was known; and then the statement that among living sharks they 'alone exhibit' the 'peculiarities' specified, was literally true.

'The palato-quadrate, not articulated with the skull,' is a true character of the typical sharks and Rhinae. Of course the apparatus, being the suspensorium of the lower jaw, must have *some* connection with the cranium; but it is indirect, and not direct. The name 'Anarthri' is therefore quite appropriate, contrasting well with 'Opistharthri' and 'Proarthri.' The newly proposed term, 'Mesarthri,' is, however, unobjectionable, although I should still, independent of priority, prefer Anarthri. No one who took an intelligent interest in the subjects in question would be misled by the name 'Anarthri,' or the diagnoses of the Anarthri and Rhinae.

I must dissent from the opinion that the Cladodontidae are related to the Chlamydoselachidae rather than to the Hybodontidae. To traverse the question would, however, infringe too much on your space.

Mr. Garman, in his substitute for my provisional diagnosis of the Selachophichthyoidei, 'vertebral condition unknown,' has added to our knowledge of the group by verifying my suggestion (*Science*, April 11, 1884) that the "anatomy will probably reveal a structure most like that of the Opistharthri."

I am pleased to find that the views of Mr. Garman as to the remoteness of the Xenacanthini or Ichthyolomi from the true selachians agree with those expressed by myself. The Xenacanthini, in fact, appear to me to be true fishes rather than selachians, although not teleosts, as has lately been urged.

Theo. Gill.

Hornblende andesite from the new Bogosloff volcano.

A short time since, there were received at the National museum, from Lieut. George M. Stoney of the Ounalaska, several fragments of rock from the new volcano on Bogosloff Island in Bering Sea. On account of the interest just now attached to this locality, it is thought a brief notice of these may not be out of place here.

The rocks are hornblende andesites. Two varieties were received, — one very light gray and slightly purplish in color, fine-grained, friable, and somewhat porous; the other dark gray in color, and much more firm and compact in texture; both varieties containing macroscopic hornblende and plagioclase, and, under the microscope, seen to be nearly identical, each consisting of a gray groundmass in which are embedded deep reddish-brown, strongly dichroic hornblendes, light green augites, and numerous crystals of a plagioclase felspar. Sanidin is also present, a very little apatite, and the usual sprinkling of iron oxides, which seem to be largely magnetite. The groundmass consists of a microfelsitic base, carrying colorless microlites, grains of opacite, and minute yellowish and greenish particles which are probably hornblende and augite. The light-colored variety contains small patches of a nearly colorless glass, while the dark variety seems felsitic throughout. A more detailed description of these rocks will be given later.

Geo. P. Merrill.

National museum, Washington,
Dec. 1.

Edison's three-wire system of distribution.

Referring to the article with the above heading in No. 94 of *Science* (Nov. 21), it is not difficult to show that the conclusions reached are not in harmony with the fundamental proposition governing the size of electric conductors. This proposition is, that "the additional running-expense due to the resistance of the conductor shall equal the interest on

its first cost." The correctness of the principle has been established by Sir William Thomson and others.[1]

In the three-wire system, Edison reduces the current to one-half its value in the two-wire system, and increases the total resistance of the same number of lamps to four times the former value, by the arrangement shown in the second diagram of the article referred to. The total heat-energy developed in the lamps, then, remains the same, since it is represented by C^2r, where r is the combined resistance of the lamps in multiple arc. The inference is, that the resistance of the leading wires should also be increased fourfold. In the articles referred to at the bottom of the page; it is shown that the cross-section of the conductor should vary simply as the current strength. Hence the conductors in Edison's three-wire system should be diminished only one-half in size for greatest economy of working. That this is entirely correct will appear from an examination of the energy expended in heating the leading wires in the several cases. In the two-wire system

$$C = \frac{E}{R + r}, \qquad (1)$$

in which R and r are the resistance of conductors and lamps respectively. In the three-wire system as arranged by Edison

$$\tfrac{1}{2}C = \frac{2E}{4R + 4r}. \qquad (2)$$

In the three-wire system, with conductors half size,

$$\tfrac{1}{2}C = \frac{2E'}{2R + 4r}, \qquad (3)$$

in which E' equals the electromotive force of each of the two dynamos in series. This electromotive force can be lower than in cases one and two. From (1), $E = CR + Cr$, and $EC = C^2R + C^2r$, for total electrical energy expended; the first term being the heat-waste in the conductors, and the second the energy expended in the lamps.

From (2), $E = CR + Cr$, as before. The total energy is $\frac{1}{2}C \cdot 2E = CE$, the same as before. From (3), $E' = \frac{1}{2}CR + Cr$, and the total electrical energy is $\frac{1}{2}C \cdot 2E' = CE' = \frac{1}{2}C^2R + C^2r$. The energy expended upon the lamps is the same in the three cases, being represented by C^2r; but in the third case the heat-waste is $\frac{1}{2}C^2R$, or only one-half as much as in the other cases. In Edison's arrangement the ratio between energy expended in the lamps, and heat-waste in the mains, is the same in his three-wire system as in the two-wire system. If the conductors be reduced to only half their former cross-section, the ratio of heat expended in conductors to heat developed in lamps is only half as great as before. Edison saves 62.5% of the cost of conductors, or 62.5% of the interest on their cost, the running-expenses remaining the same. With half-size conductors, the saving would be 25% in interest on cost of conductors, and 50% in heat-waste on conductors, or a total of 75%, —a gain of 12.5% over the plan adopted by Edison. Moreover, the electromotive force of each machine being lower, the dynamos could be reduced in size, and their cost would be less. In reducing the conductors three-fourths in cross-section, the rise of temperature for the same quantity of heat developed in them is four times as great as in the two-wire system, since their capacity for heat is reduced to one-fourth. In the case of conductors reduced one-half in size, the rise of temperature would be the same as with the two-wire plan, since the energy expended in heating them is one-half, and their thermal capacity is also one-half. We have supposed, in the calculated economy, that the three wires are all of the same size. Their combined cross-section would then be $\frac{3}{2} \cdot \frac{1}{4} = \frac{3}{8}$ of the combined cross-section of the two wires in the first plan. The saving in interest on conductors would then be 25%. Edison sacrifices running-expenses in order to diminish the size of his conductors beyond what is clearly the most economical arrangement. We take it for granted that the principle of making loss by heat-waste in conductors equal to interest on their first cost was taken into account in calculating the size of conductors in the two-wire plan.

H. S. CARHART.

Evanston, Ill., Dec. 1.

[1] *Nature*, vol. xxiv. p. 489; *American engineer*, Nov. 7, 1884.

CAN GHOSTS BE INVESTIGATED?

IN the last number of *Science*, Mr. Gurney, honorary secretary of the Society for psychical research, replies to my paper in *Science* of Oct. 17, 1884. To one whose experience has been that scientific discussion is often nugatory because the parties sedulously refuse to understand each other, it is a great pleasure to read Mr. Gurney's paper. The reader who compares it with my own, will, I think, have a fair view of the two sides of the question from the special point of view which we have heretofore taken. I therefore ask permission to consider the subject from a somewhat different standpoint.

When one adduces evidence in favor of telepathy between living persons, each having the other in mind, I am prepared to listen in the spirit of one who feels that there may be many things on earth not yet dreamed of in our philosophy. But when an imposing array of evidence is presented, tending to show telepathy between a live man and a dead one, I must frankly confess that I cannot help receiving it in the spirit of the African monarch of whom the following story is told. He had captured a Dutchman who had been trespassing on his territory, and was about to put him to death. The prisoner, however, like the heroine of the 'Arabian nights,' managed to postpone the fatal day from time to time by inventing stories about the wonders of civilization with which to regale the royal mind. When his inventive powers had reached their limit, he felt obliged to fall back upon facts,

and so told the king that the water in the lakes and rivers of his native country annually became so hard that people walked and drove upon it. The king, in a fit of rage, informed the Dutchman that he not only did not believe this story, but now he did not believe any thing he had been telling him, and ordered him to immediate execution. The reader can point the moral.

Let us now inquire whether the ghost side of telepathy can possibly be established by the methods hitherto employed for that purpose. I will start out by trying to answer the question asked Mr. Gurney in the last number, respecting the probable number of respectable credible people in the British Islands who would not be above amusing themselves at the expense of a learned society. Without waiting for his reply, I roughly estimate that the number of respectable credible people alluded to exceeds fifteen million. Knowing what we do of human nature, I conceive that it will not be considered excessive to suppose that one out of every thousand would come into the category in question. This would give fifteen thousand people who would be capable of the pleasantry alluded to. It must be expected that some of them would forward replies to such requests for information as have been circulated in England. How are the reports of such people to be eliminated from the mass? It will be hard to establish even the possibility of detecting the frauds.

It may be asked in reply whether the conclusion thus intimated, if extended to other departments of inquiry, would not lead to a general lack of confidence between man and man, and to an unjustifiable incredulity in regard to human testimony in a very wide field. My reply is, that there are wide fields in which human testimony would be wholly unreliable, but that methods for eliminating the false, and preserving the true, have come into use. These methods are so common and familiar that we forget all about them. Let us suppose that a paleontological society should advertise for human skulls found in the tertiary deposits of a country. Suppose, also, that any ingenious person could in fifteen minutes manufacture a skull which the most diligent investigation of paleontologists could not distinguish from a genuine fossil. Can any one doubt that the society would be deluged with skulls? Could any investigator be made to believe in a single one of them? I trow not. The fact is, that the only security that paleontologists have from being imposed upon by manufactured specimens lies in their power of distinguishing at a glance the true from the false. When, as in a case known to the writer, a man who has spent several months in elaborating a row of fossil bird-tracks brings his production to a museum, and is informed on sight by the professor in charge that this specimen is very interesting, because he recognizes the tracks as those of the domestic turkey, it produces a depressing effect upon all manufactures of this class. When psychic zoography is so far developed that a spurious ghost can be distinguished from a real one with the readiness with which Cuvier is said to have detected a spurious devil, there will be some outlook for establishing the existence of such beings. For this stage the reasonably incredulous will be likely to wait.

I have spoken as though the question were that of intentional deception. In fact, however, it is hardly necessary to suppose any thing of the sort. It is only the fortunate few of mankind who are not subject to lapses of memory, and illusions respecting the time and place at which events have happened, as well as to illusions of the senses. So far is this true, that a prudent person will rarely trust implicitly to a presentation of any complicated statement made by another, unless it is verified by independent evidence. If two persons could see and describe the same psychic phenomenon, the case might be better; but, as it really stands, there is no way of eliminating delusions, deceptions, or mistakes of any kind.

There is, however, a conceivable method by which every thing except intentional deception may be avoided. Let any psychical society issue to the people of a country a request that any person impressed in an unusual manner,

whether in his sleeping or waking hours, with the apparent sight or presence of a person whom he knows, shall immediately, without waiting for further investigation, state that fact on a postal-card, and mail it to the society, being careful to give the name of the person; also that any remarkable connection between this impression and any other circumstance subsequently discovered shall be sent in another communication. It should be distinctly understood that no case will be taken into account unless it is shown that the first card was mailed before the knowledge contained in the second was acquired. A correspondence of this sort might lead to something worthy of inquiry and investigation.

The evidence of haunted houses is entirely different in kind, but I must frankly admit that Mr. Gurney's reply to what I said on the subject in my previous paper does not strike me as satisfactory: indeed, he quite mistakes the point of my illustration, which was intended to show that events are all the time happening which we are unable to explain. The same logic that he uses would, it seems to me, lead to the conclusion that all tricks of the juggler which we could not explain after the most careful examination must be due to some other than known general causes. The general rule which we all unconsciously apply is, that if, upon investigating a class of seemingly unaccountable phenomena, we readily explain one-half, then explain another portion after much investigation, and with yet additional toil and industry succeed in explaining a third, but finally still have an inexplicable residuum, we conclude that this residuum could also be explained if we knew all the circumstances. This is the conclusion which everybody adopts in the affairs of common life; and I see no reason for making an exception to it in the case of that small collection of haunted houses which the committee on the subject has found it impossible to explain.

To sum up, I deem it essential that psychic investigators should find stronger evidence for the improbable than for the impossible.

SIMON NEWCOMB.

SOME IMPLEMENTS OF THE MINNESOTA OJIBWAS.

THE uses of a portion of the implements figured in Abbott's 'Ancient stone implements of eastern North America' are still somewhat open to conjecture. One group, comprising oval, grooved pebbles, has recently been reduced by Dr. Abbott to a classification comprehending mauls, club-heads, bone-breakers, and net-weights respectively (*Science*, iii. 701). These neolithic objects, and a second series closely allied to them, appearing in considerable numbers upon the New-Jersey coast, are attributed by their discoverer to the Indian races inhabiting the country when first colonized by Europeans; that is to say, to the Lenni Lenapé, or Delawares.

Now, the latter tribe, if it may still be called a tribe, is a cognate of our Algonkin-Ojibwas of the north-west. The languages of the two peoples are essentially the same, being dialects of the common Algonkin tongue, like the speech of the Canadian Crees, of the New-England Indians (preserved to us by the Eliot Bible), and of other nations. The Ojibwas, therefore, may not unreasonably be expected to retain, at the present time, vestiges of early race-ideas and race-practices which may, perhaps, serve in some way to illustrate the archeology of dead branches of the parent stock. Hence the writer of this paper thought it not amiss to set on foot inquiries touching the actual use of the two sets of implements instanced among the Ojibwas of Red Lake, northern Minnesota, where, owing to peculiar isolation, tribal peculiarities are believed to have been retained to an exceptional degree.

The members of the second series of implements, indicated above, are described as flat, discoidal pebbles, with side-notches, which in thickness vary little from about half an inch. These Dr. Abbott regards as almost certainly net-weights, considering that there would be no room for doubt upon the subject, were it an ascertained fact that the Delawares of prehistoric time were actually acquainted with the manufacture and management of nets. Now, the Ojibwas are credited by their native historian, Mr. William Warren, with making and using fishing-nets before the appearance of the whites in North America. In describing the Ojibwas seated upon the shores of Lake Superior, at La Pointe and vicinity, prior to the advent of the whites, he says: —

"The waters of the lake also afforded them fish of many kinds, — the trout, siskowit, white-fish, and sturgeon, — which in spawning-time would fill their

rivers, where, making racks across the stream, they would spear and hook up great quantities as the fish came down after spawning. They made nets of cedar and basswood bark, and from the sinews of animals. The ribs of the moose and buffalo made materials for their knives. A stone tied to the end of a stick, with which they broke sticks and branches, served the purpose of an ax. . . . Bows of wood, stone-headed arrows, and spear-heads made of bone, formed their implements of hunting and war."

Ojibwa gill-nets.—The nets used by the Red-Lakers are exclusively of the pattern known as gill-nets. When set, the apparatus depends like a perpendicular curtain from one of its longer margins, which is buoyed at the surface of the water by a succession of wooden floats (see fig. 1) tied to it at regular intervals

Fig. 1.—Net-float, 30½ inches long.

of a few feet with bits of grass, rush, bark, or of the material of which the nets are manufactured.

The net-appendages of stone are of two sorts. First, there are small manageable pebbles, or rough bits of rock, which, at intervals corresponding to those between the floats, are fastened along the under margin of the net, to hold it perpendicular in the water. These net-weights weigh a few ounces each, and are

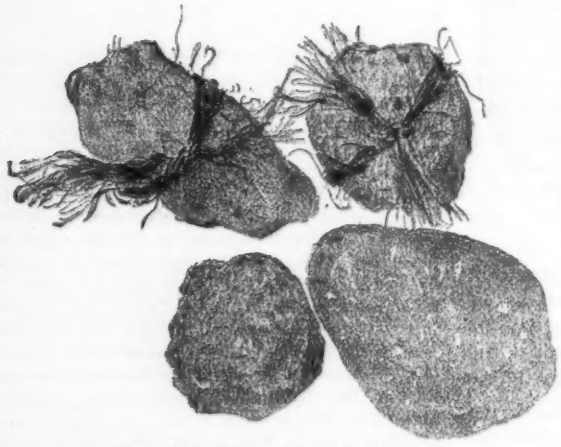


Fig. 2.—Net-weights, one-half natural size.

never notched (see fig. 2). They are simply tied about the middle with the bit of grass, etc., by which they are hung to the net.

Second, there are heavier stone anchors weighing from three or four to six and eight pounds each, which are suspended from the lower corners of the net to prevent it from drifting out of position. Sometimes one of these is also hung midway between the others. The net-anchor is also a mere unwrought block of stone of convenient size and shape. To prepare it for use, it is wound about and knotted in repeatedly with long, strong strips of bark, which, perfectly serving the purpose of cordage, enclose it in a rude kind of tackle. A lighter or heavier set of anchors is attached to a net according to existing conditions of wind and wave. The necessary anchors, with their bark investitures, are conveyed to the fishing-grounds before being hung in place, while the net-weights proper are more permanent fixtures. Indeed, I have seen the floats and stone-weights put upon the net as the work of manufacturing it went on.

Gill-nets being designed to insnare by the gills, they are adapted in size to the particular species of prey to be captured. Thus a family often employs a set of nets of different meshes. For example: Mrs. Dick Big-Bird, a Red-Lake woman of a thrifty turn of mind, keeps in stock four nets, ranging in point of mesh from small to great, and of such a length, that, when they are extended to the utmost longitudinally, they have a measurement of eighteen arm-stretches,—an arm-stretch equalling the spread of the two arms.

Lost net-weights, tied up in their little grass fastenings, occur most abundantly where they have become detached in dragging the fishing-apparatus over the ground, and likewise in spots where the women are accustomed to mend their nets and to spread them for drying. Of course, great numbers of these objects are also lost in the water from being washed out of their lashings. If we allow to a single outfit a complement of from twenty to thirty weights, with a varying equipment of anchors, we find that prodigious quantities of these stone bits must be used at one time and another, at every considerable fishing-station. The weights described would not, it is true, be recognizable in the future as remains, since they are wholly unwrought; but it is easy to imagine conditions which would necessitate the notching of these fragments, and thus render them subject to identification.

Other things being equal, it would seem that thin disks of stone would naturally be chosen for the purpose in question, as being least difficult to work notches in.

It may be proper to explain, that Red Lake lies in the Ojibwa reservation of the same name, to the north-west of the head waters of the Mississippi River. The band of about twelve hundred Indians inhabiting the reservation originated at Lake Superior, and journeyed hither by way of Rainy Lake; but it has been more or less re-enforced during its century of existence by Ojibwas of identical extraction, coming from various other northern lakes of the state, as Cass Lake, Gull Lake, and Winnibigoshish and Leech Lakes. Hence it may be inferred that the mode of net-fishing here practised is one prevailing commonly among the lake Ojibwas of the north-west; and this agrees substantially with their own statements upon the subject.

Chopping-stones. — It cannot be doubted, however, that notched discoidal pebbles have been in use among the Ojibwas from time immemorial as fuel-breakers. The objects figured in Abbott's 'Stone age in New Jersey' (figs. 204, 205), old edition (see fig. 3), are

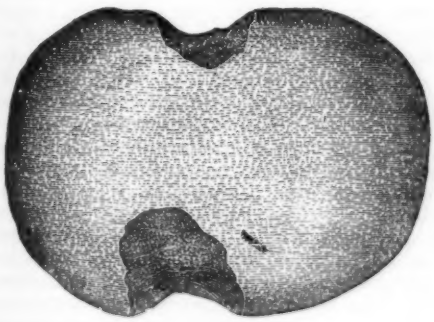


FIG. 3. — CHOPPING-STONE.

asserted by the Red-Lakers to be precisely such as are described by Mr. Warren in the quotation given above. These little implements are called axes, though they are not designed for cutting, and might with more propriety be specialized as chopping-stones. It goes without saying, that the primitive Ojibwas did not supply themselves with fuel after our fashion. They never cut body-wood for firing; but, having at command the illimitable forest with its abundance of fallen trees, they provided for warmth by simply breaking the dried bark and twigs, or large branches close at hand, into lengths suitable for their purpose. Indeed, families very generally changed their dwelling-place, during the season of greatest cold, in order to bring such supplies within easy reach.

The tools represented by these figures seem much too small for effective work in their line, but I was assured by the Indians that this is not the case. In fact, the summer fires kept up for the purpose of driving away insects, and for drying fish and other game, and corn, as well as for occasional cooking processes, are commonly maintained (many times by children) with mere twigs, and such small boughs as would be most easily separated by a chopping-stone of small size. Old Ojibwa authorities state that they know no Indians who do not avail themselves of these simple fuel-breakers whenever unprovided with better tools.

Rat-and-duck arrow. — The small object illustrated at fig. 4 is a weapon of the chase,

FIG. 4. — RAT-ARROW, NATURAL SIZE.

which is known to have been in occasional use at Red Lake as recently as a half-century ago. It was collected some years since by Mr. Elmer Hamilton, of the agency, from the beach of Red Lake, where it had been newly thrown up by the waves. A portion has been broken from the extremity of the stem, so that, as figured, it does not show the original length.

This instrument was unknown to the younger Ojibwas of the place, who, however, were of opinion that it must be something in the nature of a fish-spear. Later the object was brought to the attention of chief Leading Feather and certain other of the older members of the band, by whom it was at once recognized as a kind of arrow-point formerly used in the tribe for shooting muskrats and ducks. They called it, in fact, a rat-and-duck shooter, and they asserted that it was put to service by tying it securely at the end of an arrow, and despatching it from a wooden bow. Leading Feather and his friends had often heard of this weapon from old Ojibwa hunters, as one commonly employed by their tribe in ancient times, but at present superseded by fire-arms. Certain of the Red-Lakers claimed to have seen the implement in use during their boyhood. From all I could gather upon this subject, I judged that the rat-arrow was largely put in requisition at a former day, for destroying small animals which it was desirable to preserve unmangled.

FRANC E. BABBITT.

THE SUDAN.[1]

The Sudan, in the broadest sense of the word, is bounded on the north by the Sahara, and on the south by the 5th degree of north latitude, except in the Nile region, where its southern limit may be fixed somewhat farther south. Between these boundaries, it stretches from the Atlantic Ocean to the highlands of Abyssinia and the Red Sea. The Sudan, as the word is commonly used at the present day, is the Egyptian Sudan properly so called, or the provinces belonging to Egypt lying south of the Nubian desert. These are, going from west to east, Dongola, Berber, and Suakin on the north; Darfur, Kordofan, Khartum and Senaar, Taka and Massawa, situated, roughly speaking, between 10° and 15° north latitude; and the southern Nile provinces of Fashoda, Bahr-el-Gazelle, and Equator. On many maps, however, the word 'Nubia' will be found as including all the Nile provinces as far south as Fashoda.

There is very little known of the history of this part of the world, but the following may be taken as approximately correct. The aboriginal inhabitants of these countries were undoubtedly negroes. It is not probable that the Arabs arrived much before the advent of Mohammed; but, in the eighth century of our era, one or more Arab tribes crossed the Red Sea, and settled in the Sudan as far west and south as Senaar. They became more or less amalgamated with the negro tribes, which they conquered and converted, and whose names they in many cases took. Thus it came about that the eastern Egyptian Sudan possesses at this day a reasonably homogeneous, impure Arab population, composed of the Hadendoa, Bishareen, and other tribes.

Kordofan lies approximately between 12° and 16° north latitude, and 29° and 32° east longitude. It contains a population of not over three hundred thousand. The Nouba (Nuba), a race of very black negroes, are not unlikely the representatives of the aborigines. They live by themselves in the mountains of southern Kordofan, and speak a language of their own. They are pure negroes. Between them and the Arabs there are two mixed races, the Ghodiat and Koungarra. It has been conjectured that the Ghodiat represent the ruling race at the time of the conquest of the country by the Fur, with whom the Koungarra seem to be allied; but this is largely conjecture. These tribes live in villages, and cultivate the soil. They are thus easily distinguished from the purer Arab tribes, the most numerous of which are the Kababish and the Bagarra, all of whom are real nomads. With the exception of the Nouba, the Kordofanese are Mussulmans, and very superstitious.

Kordofan was conquered by the chief of Senaar in the last quarter of the eighteenth century, and almost immediately wrenched from his grasp by the forces of the sultan or chief of Darfur, who retained possession of the country until the Egyptian invasion in 1821. Perhaps the following from Major Prout's report to Stone pasha will convey a good idea of the mixture of races in Kordofan, where, he says, to-day one may see "all the variety of face, form, and color, which is to be found from Italy to the land of the Niam-Niam."

These and other disturbances in the Sudan attracted the attention of Mohammed Ali in 1819, and he sent an army for its subjugation. This was easily accomplished, so far as Nubia, Kordofan, and Senaar were concerned; but the Red Sea littoral, Suakin and Massawa, was not incorporated until 1864. The cruelties of Ismail, Mohammed Ali's son, were so great that he and many of his officers were treacherously burned alive at Shendy; while the defterdar, his son-in-law, so misgoverned Kordofan that it is said that Mohammed Ali had him poisoned. This was the beginning of Egyptian rule in the Sudan, and its promise has been borne out by succeeding events.

In 1853 John Petherick, the English consul at Khartum, opened up the ivory trade of the White Nile. Other foreigners followed. It was soon found that slave-hunting was still more profitable, and their energies were accordingly turned in that direction. Seribas, or stockaded villages, were built throughout the Bahr-el-Gazelle country; but "about the year 1860 the scandal became so great that the Europeans had to get rid of their stations." They sold them to the Arabs, who paid a nominal rental to the government. The life of the Nubians and other Arab peoples under the oppression of the Turks, as they called the Egyptians, was so miserable, that whole communities betook themselves to slave-hunting. From Berber to Khartum "there was not a dog to howl for his lost master. . . . Thousands had forsaken their homes, and commenced a life of brigandage on the White Nile." Thus wrote Baker in 1869, and to the same effect Schweinfurth a year earlier.

It was to put a stop to this slave-hunting that Baker, and after him Gordon, were ap-

[1] It was originally intended to give this article to the readers of *Science* in No. 93, in which the map of the Sudan appeared, but it could not be prepared in time. — Ed.

pointed governors of the equatorial Nile basin. They succeeded in stamping out the trade in the province of Equator, which was annexed to Egypt in Baker's time. This province was inhabited exclusively by pure negroes; while Bahr-el-Gazelle, where Schweinfurth lived so long, contained a large number of Arabs of more or less pure blood.

Baker and Gordon undoubtedly suppressed the slave trade of the White Nile, so far as it was carried on by water; but how much the poor slave was benefited is another question. Probably not much; for the overland march through Darfur and Kordofan must have been more destructive of life than even the voyage in a crowded Nile nugger.

One of the most powerful of these ruffian kings of Bahr-el-Gazelle was Seebehr Rahama, whose seribas were near the Darfur boundary. It was during Schweinfurth's stay in the Bahr-el-Gazelle country that Seebehr attacked and defeated some government troops who had been sent to take possession of a portion of southern Darfur. Seebehr himself then undertook the conquest of that country. The Egyptian government, thoroughly alarmed at his growing power, sent an army to co-operate, and Darfur was annexed to Egypt. This was in 1874.

Darfur, the land of the Fur, is situated between 9° and 16° north latitude, and 22° and 28° east longitude. Its area is about one hundred and five thousand square miles. Very little is known of the country; but the following facts, gleaned from Dr. Nachtigal's communication to the French geographical society in 1876, may be of interest. The population, estimated at about four millions, is as mixed as that of the other central Sudan provinces. The Fur, who live in the highlands, speak a language of their own. They are stigmatized by Nachtigal as proud, vain, cowardly, treacherous, and as disagreeable as the Wadai on the west. They are black, of moderate height, with regular features, and were the ruling race in Darfur before the coming of the Egyptians. There, as in Kordofan, there are many mixed races, and a large Arab population, especially in the northern and central portions. It must be remembered that these Arabs of the Sudan are not true Arabs, but to a great extent merely Arabized negroes.

After Seebehr had conquered Darfur, he went to Cairo for his reward; but, instead of being loaded with honors, and sent back as governor of Darfur, he was made a pasha, and kept in Cairo on a pension. His followers, led by his son Suleiman, in accordance with a preconcerted arrangement, rebelled; but Seebehr was not sent to quell the rebellion, as he had expected. The revolt was crushed by Gordon's able lieutenant, the lamented Gessi pasha, who became governor of Bahr-el-Gazelle. But upon Gordon's withdrawal, all power to do good was taken from Gessi, and he resigned.

In 1877 the khedive entered into an agreement with England, in which it was stipulated that the slave-trade should cease in lower Egypt on Aug. 4, 1884, and in the Sudan five years later. The rebellious spirit of the inhabitants had been suppressed by Baker, Gordon, and Gessi. It broke out again on the favorable opportunity which the revolt of Arabi pasha afforded. Mahomet Achmet, or El Mahdi, put himself at the head of the movement. A series of defeats was suffered by the government troops. Then came the worst blunder of all. A portion of Arabi's bashi-bazouks were sent to the Sudan under the command of Hicks pasha, a retired English army-officer. At first they were successful; but, when they attempted the invasion of Kordofan, they were surrounded, and cut to pieces. The Mahdi and his followers were supreme except in the immediate vicinity of a few garrisoned towns. It was at this juncture that Gordon was sent by the English government to report on the military situation in the Sudan. On his way he stopped at Cairo, and was commissioned governor-general of the Sudan without pay. His doings there are not known. It will be curious to see, whether when he again turns up, he still adheres to the following opinion, which he wrote just before setting out: "I am convinced that it is an entire mistake to regard the Mahdi as in any sense a religious leader: he personifies popular discontent."

NAVIGATION OF THE AIR.[1]

WE have described in detail (*Science*, No. 86) the experiment made at Chalais-Meudon on Aug. 9, when for the first time a balloon returned to its point of departure.

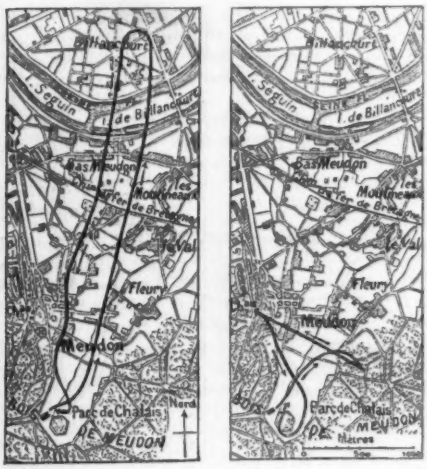
In 1852 Mr. Henry Giffard, in a steam-screw balloon, obtained a speed of about 4 metres a second. In 1872 Mr. Dupuy de Lôme, with a motor worked by seven men, attained a speed of 2.8 metres; and the Tissandier brothers, with the first balloon furnished with an electric motor, a speed of 3 metres in 1883, and of nearly 4 metres in 1884.[2] Renard and

[1] From an article by GASTON TISSANDIER in *La Nature*, Nov. 15.

[2] By an experimental trip on Sept. 26, 1884, the brothers Tissandier proved that their balloon could be brought back to its starting-point in calm weather; but, through lack of funds, they

Krebs, by the use of a more powerful and a lighter motor and a long balloon, reached a speed of about 5.5 metres a second in their first two experiments, and 6.5 metres a second in their recent experiments of Nov. 8, 1884, or 23.5 kilometres an hour, with a five-horse power, and fifty revolutions of the screw a minute.

On the 9th of November, says Tissandier, the wind was moving at the rate of 8 kilometres an hour. When the balloon was going with the wind, its speed was equal to 23.5 plus 8 kilometres, or 31 kilometres, an hour: on the other hand, when it went against the wind, its speed was 23.5 kilometres minus 8 kilometres, or 15.5 kilometres, an hour. The balloon was easily guided in all directions.



The first ascent took place at noon. When the balloon had risen above the surrounding obstructions, the working of the screw was begun; and the balloon, tacking about, was directed in a straight line toward the viaduct of Meudon, which it soon reached. It crossed the Seine below the bridge of Billancourt, became entangled on the right bank of the river, and the motor was stopped, and the balloon allowed to go with the wind, in order to measure the rate of the current. After a rest of five minutes, the machine was again put in motion; and the balloon, guided by the rudder, described a semicircle of about 160 metres diameter, and returned to its starting-point at a slow rate, but with perfect stability. At three P.M. Renard and Krebs began a second experiment. The balloon arose a second time, and made several excursions in the neighborhood of Chalais; but the fog was so thick, that the second ascent only occupied thirty-three minutes through fear of losing sight of the landing-place. A return to the place of departure was easily effected, as before. The accompanying maps give the exact routes of the two trips.

These new experiments are decisive. Navigation of the air by means of long balloons provided with screws is demonstrated. We will repeat, what we have already said many times, that to be practicable and useful, aerial ships must be made very long, of very large dimensions, which shall carry very large machines, capable of giving a speed of from 12 to 15 metres a second, allowing their working at almost any time. When the wind is high, or there is a squall or tempest, aerial ships must remain in port, as other vessels do. It becomes now only a question of capital.

have not been able to provide a shelter for the inflated balloon, that it might be ready to set out in favorable weather.

A NEW LAW OF ORGANIC EVOLUTION.

I HAVE in another place given many reasons for believing that the male cell has, by division of labor, gradually acquired the function of exciting variation, while the ovum transmits the established characteristics of the race. The following facts, among others, seem to indicate that a specialization of this sort actually exists. 1.° There is no evidence that the functions of the two sexual elements are alike, but the possibility of parthenogenesis shows that the ovum in itself can transmit all the established characteristics of the race. 2°. Organisms born from fertilized eggs or seeds are much more variable than those which are produced asexually. 3°. The children born from a male hybrid with the female of either pure form are much more variable than those from a female hybrid with the male of either pure form. 4°. Parts which are confined to males, or which are of more functional importance in males than in females, are much more variable than parts which are confined to females, or which are of more functional importance in females than in males. 5°. Males are more variable than females. 6°. The male leads, and the female follows, in the evolution of new features, as is shown by the fact that the females of allied species are more like each other, and more like the young, than the males are. This cannot be due to sexual selection; for it holds true to a remarkable degree in domesticated pigeons, and in other animals which are paired by the breeder.

Now, if it is true that the tendency to vary comes through the influence of the male parent, it will be for the advantage of the species to give birth to an excess of females, so long as the conditions of life are favorable, and change is not needed, and to give birth to an excess of males whenever the conditions of life become unfavorable, and thus demand new modifications.

Düsing has recently published[1] a very valuable and highly suggestive series of papers upon the laws which regulate the sex of the embryo in mankind, and in other animals, and in plants; and the facts which he has brought together seem to show that this specialization actually exists, and that a favorable environment

[1] *Jenaische zeitschrift*, xvi. iii. 1883, 428, and xvii. 1884, 593-940.

causes an excess of female births, while an unfavorable environment causes an excess of male births.

Among mankind the conditions of life are so much under control, that it is difficult to say just what constitutes a favorable environment; but I think we may safely conclude that a high birth-rate indicates that the conditions of life are favorable, and that a decrease in the birth-rate indicates decreased prosperity, and that human races which are disappearing are so doing because surrounding conditions are no longer favorable.

Düsing gives many facts to show, that, as the birth-rate increases, the number of boy-births to each 100 girl-births decreases, and *vice versa*. At the Cape of Good Hope the Boers are very prolific: six or seven is a small family, and from twelve to twenty children are not unusual, and 100 girls are born to every 97.2 boys. The Hottentots, on the other hand, are very infertile: many of the women are barren, and they seldom have more than three children, and 103.9 boys are born to each 100 girls.

The birth-rate is higher in towns than it is in the country, and the ratio of boys is greater in the country than it is in the towns. In 1881 the average for the whole of Prussia was 106.36 boys to each 100 girls; and in all the towns the boy-births were below this average, and above the average in the country. Ploss has shown that in Saxony the ratio of boy-births rises and falls with the price of food.

From nearly 10,000,000 births, Düsing has compiled a table to show the birth-rate, and the ratio between the sexes, for each month in the year; and this table shows that the ratio of boy-births is the highest when the birth-rate is lowest. In March the birth-rate was highest (942,488), and the ratio of boy-births was lowest (105.92 boys to each 100 girls); while in June the birth-rate was lowest (812,469), and the ratio of boys highest (106.77).

Among the lower animals, it is difficult to obtain statistics: but Düsing states that domesticated animals are more prolific than their wild allies, and that there is a greater number of female births; that, when animals are taken from a warm to a cold climate, the ratio of male births increases; and that leather-dealers state that they obtain most female skins from fertile regions with rich pastures, and most male skins from more barren countries.

The power of parthenogenetic reproduction seems, in many cases, to have been acquired in order to permit an unusually great and rapid increase in the birth-rate, when the conditions of life are unusually favorable; and in these cases the parthenogenetic eggs give birth to females almost exclusively. Among the parthenogenetic Cladocera, both males and females are found in the fall and in the early spring; but during the warm months only females are found, and they multiply so rapidly, that, according to Ramdohr, a female Daphnia can in sixty days produce 1,291,370,075 parthenogenetic female descendants. As the supply of food fails in the fall, males make their appearance; and Kurz has shown that any unfavorable change causes the production of males. He says that males appear when food fails, when the water dries up, when it becomes too dense, when it acquires an unfavorable temperature, or, in general, when there is a decrease in prosperity. From these and many other facts recorded by Düsing, I think we may safely conclude, that among animals and plants, as well as in mankind, an unfavorable environment causes an excess of male births, and a favorable environment an excess of female births.

Now, why should this be so? If the welfare of the species can be secured, under a favorable environment, by females alone, why are males needed when the environment becomes unfavorable? I believe that we have, in the facts recorded by Düsing, an illustration of one of the most important and far-reaching of all the adaptations of nature, — an adjustment which tends to cause variation when it is needed, and to keep things as they are, so long as no change is demanded. As the conditions of life become unfavorable, variation becomes desirable in order to restore the adjustment between the organism and its environment; and this is secured by an increase in the ratio of male births.

That this is the true explanation of the phenomena, is shown, I think, by the contrast between domesticated animals and captive animals. The fact that an animal has become domestic shows that it finds in captivity a favorable environment; and Düsing says that domestic animals are exceptionally fertile, and that they produce an excess of females. Animals which are kept as captives in menageries and gardens, have, as a rule, no fitness for domestication; and Geoffroy St. Hilaire says that individuals born in menageries are usually male, while skins sent to museums are usually female; and that the attempt to domesticate a wild animal increases the number of male births. Düsing states that captive birds of prey, and carnivorous mammals, are very infertile, and that the young are nearly always males.

The wild human races of Oceanica and America are much like captive animals, as they have been suddenly thrown into contact with a civilization which has been in Europe the slow growth of thousands of years. Food and climate have not changed, but a new element has been introduced into their environment. The New-Zealanders are very infertile, and nearly all the children are boys; and the census of 1872 for the Hawaiian Islands gave a ratio of 125 male births to each 100 female births.

I believe we may see, in these instances, the last struggle of nature to save the race from extermination by the production of a favorable variation. It is proper, however, to point out that Düsing himself gives a different explanation of the excess of male births under unfavorable conditions of life, although I believe that examination will show that his explanation is inadequate.

He says that the excess of male births is for the purpose of preventing close inter-breeding. He shows that inter-breeding causes sterility, small size, and lack of general vigor and vitality; and he also shows that these effects are most marked when the other conditions of life are least favorable, and that no evil effects follow inter-breeding when food is abundant,

and when the environment in general is conducive to prosperity. Since the evil effects of inter-breeding become more marked as the environment becomes less favorable, and as male births are then in excess, he believes that the excessive production of males is an adaptation which has gradually been acquired by natural selection, for the purpose of preventing close inter-breeding at the time when it is injurious; but, as an injurious property cannot be established by natural selection, the evil effects of inter-breeding cannot be primary. The end which is advantageous, and which has been secured by natural selection, is the crossing or sexual union of individuals which are not closely related. As the object of crossing is to secure variability, it is most necessary when change is needed; that is, when the conditions of life are unfavorable.

Natural selection has accordingly acted to secure this by rendering the offspring of a cross more able to resist an unfavorable change than the offspring of closely related parents, or the parthenogenetic children of a single parent; and the excessive production of males under an unfavorable environment is for the purpose of securing variation, rather than the prevention of inter-breeding.

This very suggestive topic opens many fields for research where our information is very scanty; and any readers of *Science* who are able to contribute information regarding the number of births of each sex in wild or captive or domestic animals will help to a clearer insight into an extremely interesting and important problem. The writer will gladly receive and tabulate information upon this point, and will give proper credit to contributors.

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CONTEMPORARY SOCIALISM.

Contemporary socialism. By John Rae, M.A. New York, *Scribner*, 1884. 13 + 455 p. 8°.

Among the merits of this volume may be mentioned the spirit with which the subject of socialism is approached. The author, understanding that his position is not that of an advocate either of existing society or of any proposed future social form, attempts to present an impartial but critical account of the schemes which contemporary socialists assure us will inaugurate an earthly paradise. Mr. Rae indulges neither in abuse nor declamation nor frightened outcry, but manifests a judicial calmness of temperament, befitting a man of science.

The scope of this work is indicated by the titles of the chapters, which are the following: Introductory, containing a preliminary survey of the field; Ferdinand Lassalle; Karl Marx; The federalism of Carl Marlo; The socialists of the chair; The Christian socialists; Russian nihilism; Socialism and the social question; Progress and poverty; Henry George.

The arrangement of topics is not at all what one might expect, and is due, perhaps, to the fact that the book consists, in part, of articles previously published in the *Contemporary review* and the *British quarterly*. These have been enlarged, and supplemented with additional chapters, and the old and new are not well joined together. It exhibits more or less of the character of patchwork in many places; each chapter not leading naturally to the following, nor being an outgrowth of what has preceded. Thus Lassalle, who built on Marx and Rodbertus, and who simply interpreted their doctrines to the common people, kindling in their breasts a fire of enthusiasm not yet extinguished, is treated in the second chapter; while Karl Marx, his logical predecessor, follows. Rodbertus, the father of scientific socialism in Germany, of whom Marx is only a further evolution, receives no separate treatment at all, and is barely alluded to in the chapter on Marlo. The greatest figure in modern socialism is thus passed by in scarcely half a dozen words, in a work professing to give a picture of contemporary socialism. French socialism fares scarcely better, receiving only three or four pages in the introductory chapter, and that in a work of four hundred and fifty-five pages. This is certainly inadequate. Henry George, on the other hand, who, it is acknowledged, is not a socialist in the ordinary acceptation of the term, receives seventy-seven pages.

The book is a disappointment; because it is a series of detached essays, instead of a connected whole, and is not what a perusal of the author's articles in the *Contemporary review* might reasonably have led one to expect. The entire work betrays either indolence, or lack of sufficient time for the adequate performance of the author's task; for it ought to have been re-written, the style improved, a more philosophical and symmetrical arrangement secured, and more careful attention given to the most recent phases of contemporary socialism. Parts of the book were written several years ago, and, though perhaps true then, are not accurate now; and, even in the apparently more recent additions, there is an oversight of what is transpiring at the present time. Thus, on p. 56, Mr. Rae uses these words: "England is the only great country where socialism has at present neither organ nor organization that reaches the public eye or ear." This sounds strange, for in this country we hear frequently

of the 'democratic federation,' and at least three periodicals of a radically socialistic nature are supported, — viz., the monthly *To-day*, and the weeklies *Justice* and *Christian socialist*, — while Hyndman's books, 'England for all,' 'The historical basis of socialism,' etc., have certainly attracted wide discussion, as have also the contributions of the poet Morris to the literature of socialism. American socialistic movements likewise receive entirely inadequate attention; and the impression is conveyed that there is practically no American socialism, — a most radical error.

One of the peculiarities of modern socialism is its unexpectedness wherever it makes its appearance. This is brought out in several places by Mr. Rae. Referring to German socialism, on p. 61 he says, "Professor Lorenz von Stein of Vienna, . . . who wrote an acute and thoughtful book on French communism in 1842, says in that work, that Germany, unlike France, and particularly England, had nothing to fear from socialism because Germany had no proletariate to speak of. Yet in twenty years we find Germany become suddenly the theatre of the most important and formidable embodiment of socialism that has anywhere appeared." This is a correct statement. Again and again it was said that communism was a French disease, from which Germany had nothing to fear; as her peace-loving, laborious, frugal, and contented laborers could never become infected with the poison of discontent. Now, to use a socialistic phrase, she leads the labor battalions of the world. Less than ten years since, Englishmen boasted that socialism was a continental plague, from which the free institutions of England, and the manly, self-reliant character of her sons, forever exempted the British Isle: now it is doubtful whether socialism has anywhere a more respectable following, and even the government is influenced by socialistic ideas. A tinge of socialism is diffusing itself over the institutions of England, the classic land of *laissez-faire*. And in America how proud has been our self-confidence! With what satisfaction have we pointed to our broad prairies, offering homes to all! With what contentment have we talked about the prosperity of the American laborer! With what scorn have we referred to the pauper labor of Europe! Surely no sane man could expect a social disease like socialism in the United States. But here it is, and it is nowhere making more rapid strides. The proof of this is on every hand. It is but necessary to open one's eyes, and watch the movements of the laboring classes. Their parades, mottoes, labor-unions, newspapers, conventions, and congresses tell the tale; but of all these, Rae has little or nothing to say.

The book is timely, and it is unfortunate that our author did not do himself better justice in a more carefully prepared treatise.

THE FACE OF THE EARTH.

Das antlitz der erde. By E. SUESS. Abteilung i. Leipzig, *Freytag*, 1883. 310 p., illustr. 4°.

DR. EDUARD SUESS of Vienna, well known among geological readers for his original writings on the structural relations of earthquake disturbances and on mountain building, has in preparation a more general work on the 'Face of the earth,' in which he attempts, by a critical review of recent studies, to correct a number of surviving errors, and prepare the groundwork for an unprejudiced view of dynamical geology. The first part of the work, already published, contains a discussion of motions in the outer crust of the earth, and of the structure and course of some of the larger

OVERTURNED FOLD IN THE MAMBANG PASS.

mountain ranges. Under the former heading there is an extended essay on the deluge, which has been printed apart, and briefer chapters on earthquakes, dislocations, and volcanoes. The second heading includes, thus far, only the Alpine system.

The work shows a broad acquaintance with the subject; and, in spite of its title, it is not a 'popular' book. Yet its style is much more attractive and readable than one usually expects in a geological essay. Among the more novel topics, there may be mentioned the brief account of Fischer's and Hann's studies of the deformation of the ocean's surface by continental attraction; a summary of the evidence

RESTORATION OF A DISTURBED REGION OF PALEOZOIC ROCKS IN BELGIUM.

contradicting the often quoted elevation of the Chilian coast in the earthquakes of 1822, 1835, and 1837; the series of forms developed in an eruptive region by deeper and deeper denudation; and the relations of the curved trends of the Alpine system to the generally northward tangential thrust that produced it.

A moderate number of well-executed cuts, and several long lists of authorities, add to the value of the work. The first of the illustrations here copied shows an overturned fold on the Mamrang pass, in the north-western Himalaya: the second is a restoration, by Cornet and Briart, of a greatly disturbed region of paleozoic rocks in Belgium, over part of which cretaceous strata are laid unconformably. Of the three great faults, *AA* is the oldest, and *CC* the youngest.

A POPULAR WORK ON AMERICAN NATURAL HISTORY.

Tenants of an old farm, leaves from the note-book of a naturalist. By Henry C. McCook, D.D. New York, *Fords, Howard, and Hulbert*, 1885. 456+4 p., illustr. 8°.

Scientific men are accustomed to consider themselves an exclusive body. They collect bits of knowledge, which they seem to look upon as their private property, and, either wisely or unwisely, spend their time making observations, and rigidly describing them for scientific ears, with no attempt to put the material within reach of the ordinary mind. The result is, that the popular books of science, from which the general reader must get his information, are usually compiled by persons who have never seen what they are describing, but have obtained their information entirely from others. A book like the one before us is therefore of special value, for we have in it a popular account of scientific subjects by one who has himself observed every thing he describes. The scientific statements of the author are not only reliable, but, coming directly from nature, they still retain evidence of direct contact with life, which is so sure to disappear with too many repetitions; and when, further, these statements are put in a form to appeal to the general reader, we may be sure of an addition, perhaps not to science, but to the knowledge of the reading public.

The author informs us, that under the persuasions of friends, and rather against his own inclination, the plan of the book is colloquial in form. What the book might otherwise have been cannot be said, but the persuasion of friends seems here to have had a happy effect. The desirable quality of a popular scientific book is to obtain as many readers as possible, and thus spread the knowledge widely. However interesting facts of natural history

may be in themselves, it yet remains true that man is more interested in man than in any thing else; and scientific information given in the form of conversations, as in this book, is not only more interesting, and sure to obtain more readers, but makes a much more lasting impression.

The plan of the book is this: a city merchant who was formerly a naturalist is ordered by the doctor to take a year's rest in the country. He obeys the order, and occupies his time, while regaining health, in resuming his old acquaintance with the insect world. Various persons are introduced, who become interested in the oddities found, and weekly conversations to the household upon insects are the result. The author, assuming the character of the naturalist, details to his listeners a great many interesting and valuable bits of information upon their natural history: their life-history and habits, the damage which they do, with occasionally the method for its prevention, are discussed. A classical student introduces the mythology and classical lore relating to the subject; two farm-hands are thoroughly acquainted with the various superstitions connected with insects; the peculiar habits give opportunity for occasional moral lessons; while a 'school-ma'am' enlivens the party with her wit. The classical student, being a clergyman, serves to introduce the relation of evolution to religion, and is made to say, "As a method of creation simply, I am willing to leave it in the hands of the naturalist and philosopher," — a conclusion which, happily, is being reached by all thinking men. In short, these conversations, and the experiences detailed, give to the non-scientific reader a pleasant and accurate account of many of the animals which he is sure to meet in his walks in the country. The work is not a scientific one. It is true that there are a few new observations given; but they are so absorbed in the general character of the book that their value disappears, for no naturalist would be apt to go to a book of this nature for scientific information.

The illustrations form not the least attractive feature. These are very numerous, — about a hundred and fifty in all, — all new, and drawn especially for this work. Of themselves, they will insure many a purchaser. It is somewhat to be regretted that so many of them are simply humorous in nature. The whimsical oddities of Mr. Beard are certainly unique and excellent, but seem somewhat out of place, giving to the pages the appearance of humorous selections. While they do somewhat enliven the book, the reader cannot help wishing that their place were filled with more of the sketches from nature from the author's sketch-book, whose excellence is verified by the many examples given.

NOTES AND NEWS.

GEN. F. A. WALKER, of the Massachusetts institute of technology, has published a brief paper on industrial education, which he read before the American social science association in Saratoga last September. This interesting paper bears upon the questions which are under discussion in Glasgow. Gen. Walker offers the following classification of schools devoted to industrial education: —

1. Schools of applied science and technology, such as the school over which he presides, the Sheffield scientific school, the Stevens institution, the Rensselaer polytechnic institute, and the like.

2. Trade-schools, in which a particular art, or branch of industry, is taught; as, for example, watch-making in Switzerland.

3. Schools in which manual and mechanical education is introduced as a part of the general education of the scholar with reference to the fuller development of all his powers, not to make an engineer on the one hand, nor a trained operative on the other.

Gen. Walker advocates with clearness and vigor the gradual introduction of manual training in the public schools, and sketches what he calls 'a fairly conservative programme,' which would involve only a slight disturbance of the structure of the existing schools, but would call for a surrender of a considerable portion of time to the new studies. Gen. Walker seems at a loss for a phrase or term with which to indicate the training he desires to give. We suggest 'handicraft.' Let handicraft be taught in every school for girls or boys, in the kindergarten, and in the scientific laboratory. 'Handicraft' will make a good rallying word for all who favor this new phase of popular education.

— We would call the attention of our readers to the following remarks by Sir William Thomson during an address at Philadelphia last summer: "You in this country are subjected to the British insularity in weights and measures: you use the foot and inch and yard. I am obliged to use that system; but I apologize to you for doing so, because it is so inconvenient; and I hope all Americans will do every thing in their power to introduce the French metrical system. I hope the evil action performed by an English minister whose name I need not mention, because I do not wish to throw obloquy on any one, may be remedied. He abrogated a useful rule, which for a short time was followed, and which I hope will soon be again enjoined, that the French metrical system be taught in all our national schools. I do not know how it is in America. The school system seems to be very admirable; and I hope the teaching of the metrical system will not be let slip in the American schools any more than the use of the globes. I say this seriously. I do not think any one knows how

seriously I speak of it. I look upon our English system as a wickedly brain-destroying piece of bondage under which we suffer. The reason why we continue to use it is the imaginary difficulty of making a change, and nothing else; but I do not think in America that any such difficulty should stand in the way of adopting so splendidly useful a reform."

— Professor George Davidson of the Coast and geodetic survey, San Francisco, informs us that the account of the volcanic eruption of Mount St. Augustin, Cook's Inlet, Alaska, prepared by him, and published in *Science*, No. 54, Feb. 15, 1884, was wholly derived from an account by Capt. Sands, and is seriously in error. It appears that Capt. Sands saw the eruption only from a distance of about fifty miles, in unfavorable weather, and therefore derived his information about details from the natives or from his imagination. The splitting of the island in twain, the formation of new islands, etc., appear not to have occurred. According to Capt. Cullie of the Alaska commercial company, who visited the island, there has been a great land-slide on the north-north-west side of the mountain, leaving a precipitous bluff over which has poured lava and eruptive matter filling up the rocky boat-cove there. He further reports that a reef running westward, and formerly submerged, is now elevated to the sea-surface. The volcano above the great slide was actively smoking or steaming at the time of his visit last summer. This information is in confirmation of that printed in *Science*, No. 73, June 27, 1884.

— Lord Rayleigh has resigned the Cavendish professorship of experimental physics at Cambridge, Eng.

— The department of biology of the University of Pennsylvania was formally opened on the 4th with an inaugural address by Professor Harrison Allen, one of the principal promoters of the enterprise.

— Mr. H. E. Dore of Portland, Ore., has discovered Zonites cellaria Muller somewhat abundantly in that city, while the native helices appear to be receding from the vicinity of civilization. The intruder, now for the first time reported from that region, is a European species living in damp places, and apparently with a *penchant* for travel. It was introduced at Charleston, S.C., nearly a century ago, and described by Say as a new species. It has been found along our eastern coast in many cities, and in Manila, Japan, the Hawaiian Islands, and many other widely distant regions which are visited by European ships, and seems to flourish equally well everywhere.

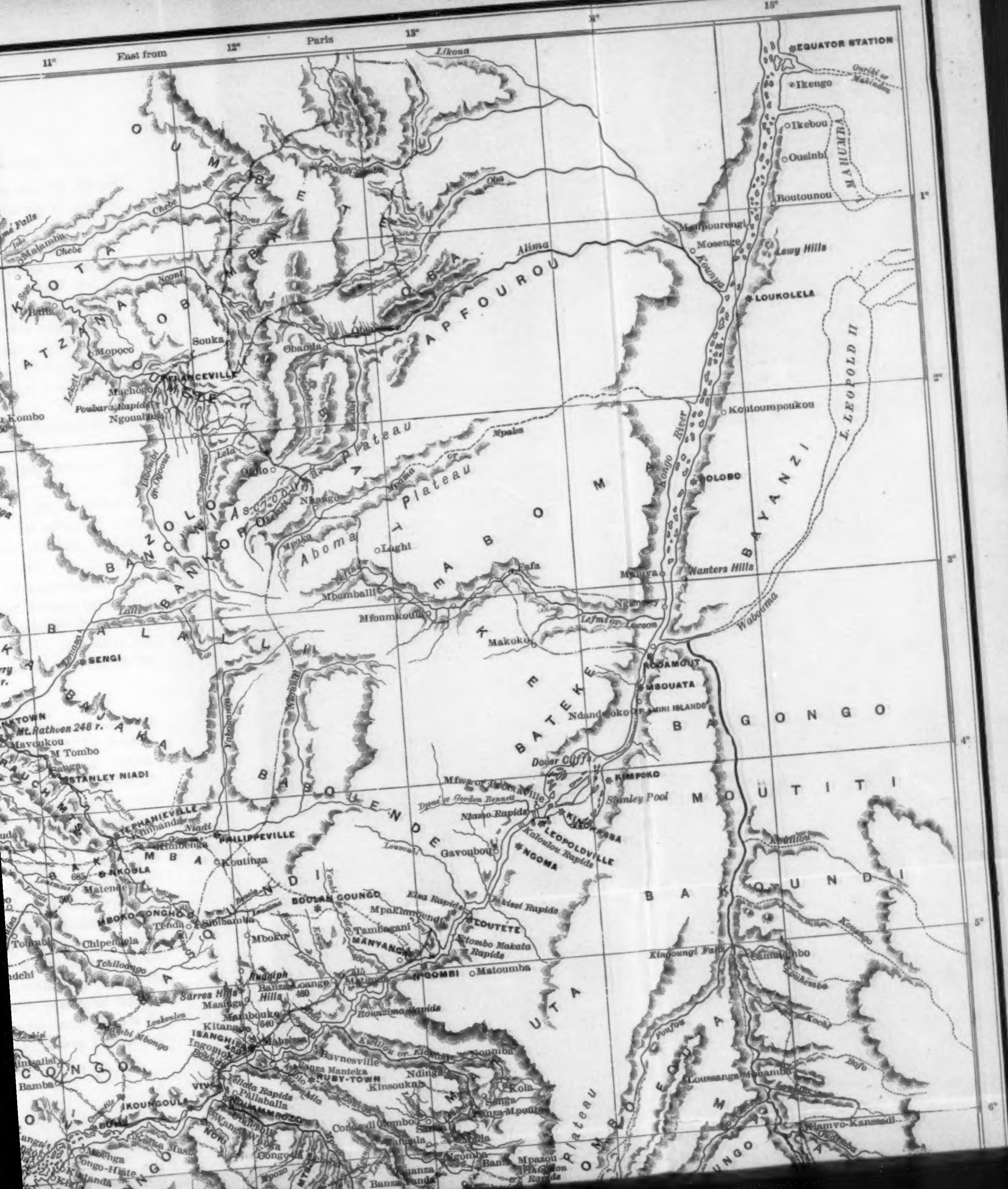
— In the journal of the Anthropological institute of Great Britain for November, 1884, Dr. Flower discusses the size of teeth as a race-character in man. His observations were made upon all those skulls, out of the three thousand in the collection of the museum of the Royal college of surgeons, which retained the bicuspid and molar teeth of either side in the upper jaw. These five teeth he measured in a straight line along the crowns, from the anterior margin of the first bicuspid to the posterior margin of the last molar, to get the 'dental length.' This absolute length is not sufficient in comparing races, for smaller races might naturally be supposed to have smaller teeth; so that it was necessary to find some standard of length as indicating the general size of the cranium, with which to compare the dental length. For this purpose, there was chosen the length of the base of the skull from the anterior margin of the foramen magnum to the point where the nasal bones are set upon the frontal. The expression in figures, of the proportion between the length of these five teeth and that of the base of the skull, is known as the 'dental index.' The average dental indices of the human races represented in the collections examined range between forty and forty-eight: and for convenience of classification they are divided into microdont, with proportionally small teeth, index below forty-two; mesodont, with medium-sized teeth, index between forty-two and forty-four; megadont, with large teeth, index above forty-four. Six gorillas, six chimpanzees, and as many orangs, examined, were found to be strongly megadont; while a male siamang proved to have molar teeth scarcely larger, in proportion to the skull, than the higher races of man. The megadont human races are the Tasmanians, Australians, Andamanese, and Melanesians of various islands. The mesodont races are the African negroes of all parts; Malays of Java, Sumatra, etc.; American Indians of all parts; and the Chinese. The microdont races are the low-caste natives of central and southern India; the Polynesians; the ancient Egyptians; mixed Europeans, not British; and the British. While the separation into groups is necessarily arbitrary, it seems to be not wholly unnatural, since it accords in a general way with the familiar classification based on color; the microdont section including all the so-called Caucasian or white races, the mesodont the Mongolian or yellow races, while the megadont is composed exclusively of the black races, including the Australians.

— The Royal academy of sciences in Turin celebrated its hundredth year in July, 1883, and, in commemoration of its centennial, has issued a quarto volume of nearly six hundred pages. In this may be found biographical sketches of the three founders of the academy, — La Grange, the famous mathematician; Saluzzo di Monesiglio, the physician and chemist; and Cigna, the anatomist and natural philosopher. The two first named were successively presidents of the academy; and they were followed by Morozzo, a physician and mathematician. His name is followed by that of Napoleon Bonaparte, who was chosen president while he was first consul. A brief history of the academy is given, and lists of the officers and members, an analytical table of the contents of the society's transactions, and, finally, an elaborate alphabetical index to names and subjects mentioned in the transactions. Among the associates of the academy are our countrymen, James D. Dana and George Bancroft, who are foreign members, and William D. Whitney, who is a corresponding member.

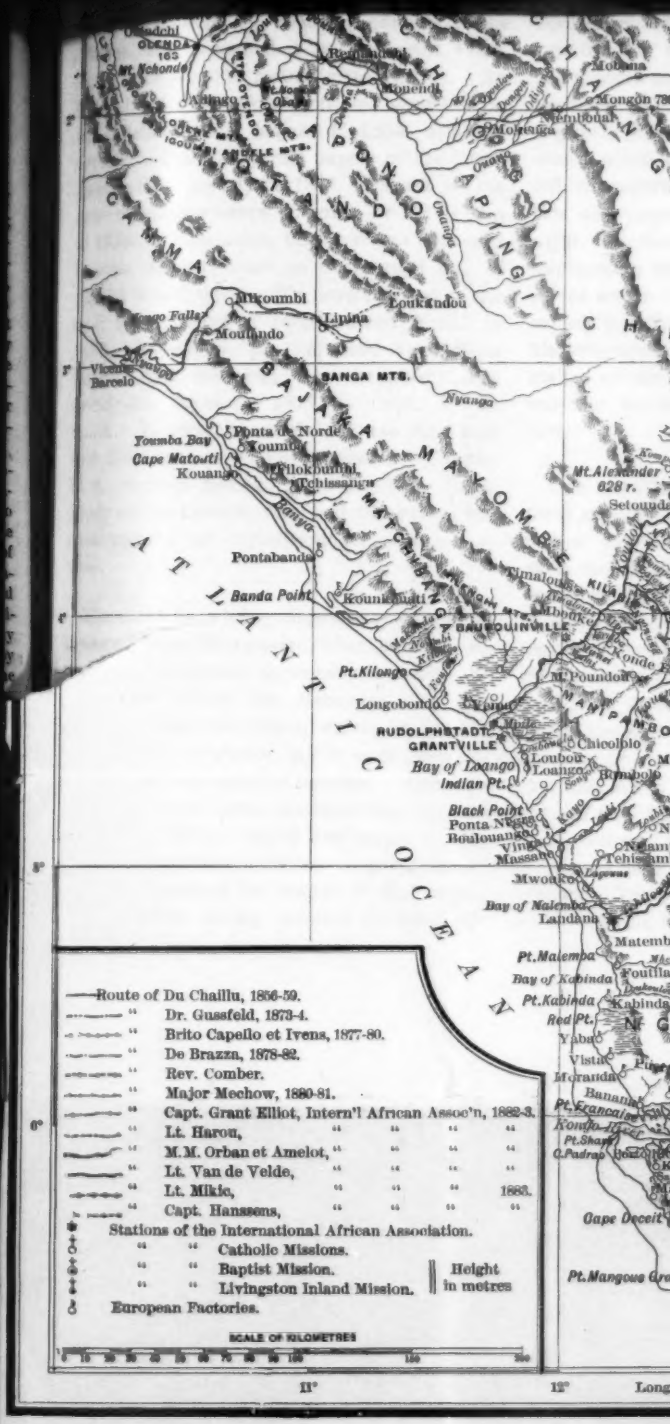
— Prof. T. C. Mendenhall has been appointed chief electrician of the U. S. signal-bureau.


Longitude
East from
8°
9°
10°
11°
12°
1°
2°
3°
4°
5°
6°
OKANDA
BANGOUEN
ASKELLA
ILIENGA
NCHAVI
ACHANGO
APINGI
OTANDO
CAMMA
CHIACK
BAJAKA
MAYOMBE
KACONGO
NGOYO
ATLANTIC OCEAN
Mt. Elebe
Sam Quita
Biaia
Alemba
Lake Isanga
Lake Anengue
Ikango
Samba Rapids
Nagochi Rapids
Mt. Murchison
Mandchi
Npopo
Opangani
Mt. Nageobelle
Olenda
Mt. Nchonde
Djolonda
Doumé Falls
Malamba
Chebe
Mopoco
Souka
Franceville
Machogo
Poubara Rapids
Ngoualaha
Mobana
Mouaou Kombo
Mongon 786
Mt. Berougou Bouanga 810
Mokenga
Moukandou
Mikoumbi
Moulando
Lipina
Loukandou
Mongo Falls
Vicente Barcelo
Sanga Mts.
Nyanga
Youmba Bay
Cape Matouti
Kouango
Ponta de Norde
Pontabanda
Banda Point
Kounkouati
Mt. Harry 471 r.
Mt. Alexander 628 r.
Mt. Rathuen 248 r.
Setounda
Mavoukou
M Tombo
Stanley Niadi
Sengi
Granttown
Baudouinville
Pt. Kilongo
Longobondo
Rudolphstadt
Grantville
Bay of Loango
Indian Pt.
Loango
Black Point
Ponta Negra
Boulouanao
Massabe
Mwouko
Bay of Malemba
Landana
Pt. Malemba
Bay of Kabinda
Pt. Kabinda
Kabinda
Red Pt.
Yaba
Vista
Moranda
Banana
Pt. Francaise
Manipambou
Mavambo
Banga
Mondo
Chicolblo
Touabi
Chipendela
Tchiloango
Mbouka
Nkoula
Matende
Stephanieville
Philippeville
Koutinga
Mboko Songho
Sarres Hills
Banza Hills
Isanghila
Vivi
Boma
Ikoungoula
Nkonde Ndinchi
Route of Du Chaillu, 1856-59.
" Dr. Gussfeld, 1873-4.
" Brito Capello et Ivens, 1877-80.
" De Brazza, 1878-82.
" Rev. Comber.
" Major Mechow, 1880-81.
" Capt. Grant Elliot, Intern'l African Assoc'n, 1882-3.
" Lt. Haron " " " "


Longitude
8°
9°
10°
1°
5°
6°
Bouimba Falls
OKANDA
BANGOUEN
ASKEFLA
IRENGA
Lake Nkemi
Mt. Elebe
Sam Quita
Lake Isanga
Lake Ele
Mt. Igoumbi
Ikango
Samba Rapids
Mt. Murchison
Mandchi
Mbaou
Onangano
OLENDA
Mt. Nchonde
Alingo
Mt. Ngongo
ACHANGO
ASHANGO
ANCHAVI
APONO
OTANDO
APINGI
CAMMA
ADOUMA
Djokonda
Nghemi
Doumé Falls
Lolo
Malamba
Mouaou Kombo
650
Komo
Mongon 786
Mt. Berougou Bouanga
870
Nembouai
Mohenga
Ouango
Ovigou
Remandji
Monendi
Oudanga
Loukandou
Mikoumbi
Lipina
Moulando
Vicente
Barcelo
SANGA MTS.
Nyanga
BAJAKA
MAYOMBE
CHIACK
Mt. Harry
471 r.
Mt. Alexander
628 r.
FRANKTOWN
Mt. Rathven 248
Mavoukou
M Tombo
Setounda
Youmba Bay
Cape Matouti
Kouango
Ponta de Norde
Youmbi
Tchissanga
Banya
MATCHIMBANGA
Pontabanda
Banda Point
Kounkouati
Timalouma
BAUDOUINVILLE
Mbouko
Konde
Mvouti
Bouda
M. Poundou
Pt. Kilongo
Longobondo
MANIPAMBOU
Mavambo
Banga
RUDOLPHSTADT
GRANTVILLE
Chicolblo
Bay of Loango
Indian Pt.
Loubou
Loango
Mondo
Black Point
Ponta Negra
Boulouanambo
Vinga
Massabe
Nkonde Ndindchi
Nsampoulou
Tchissambo
Mwouko
Bay of Malemba
Landana
Matemba
Pt. Malemba
Bay of Kabinda
Pt. Kabinda
Foutila
Kabinda
Chimfalisi
Bamba
Red Pt.
KACONGO
NGOYO
Yaba
Vista
Moranda
Banana
Pt. Francaise
Kongo-Izezi
Pt. Shark
C.Padrao
Chipe
ATLANTIC OCEAN
Route of Du Chaillu, 1856-59.
" Dr. Gussfeld, 1873-4.
" Brito Capello et Ivens, 1877-80.
" De Brazza, 1878-82.
" Rev. Comber.
" Major Mechow, 1880-81.
" Capt. Grant Elliot, Intern'l African Assoc'n, 1882-3.
" Lt. Harou, " " " "
" M.M. Orban et Amelot, " " " "

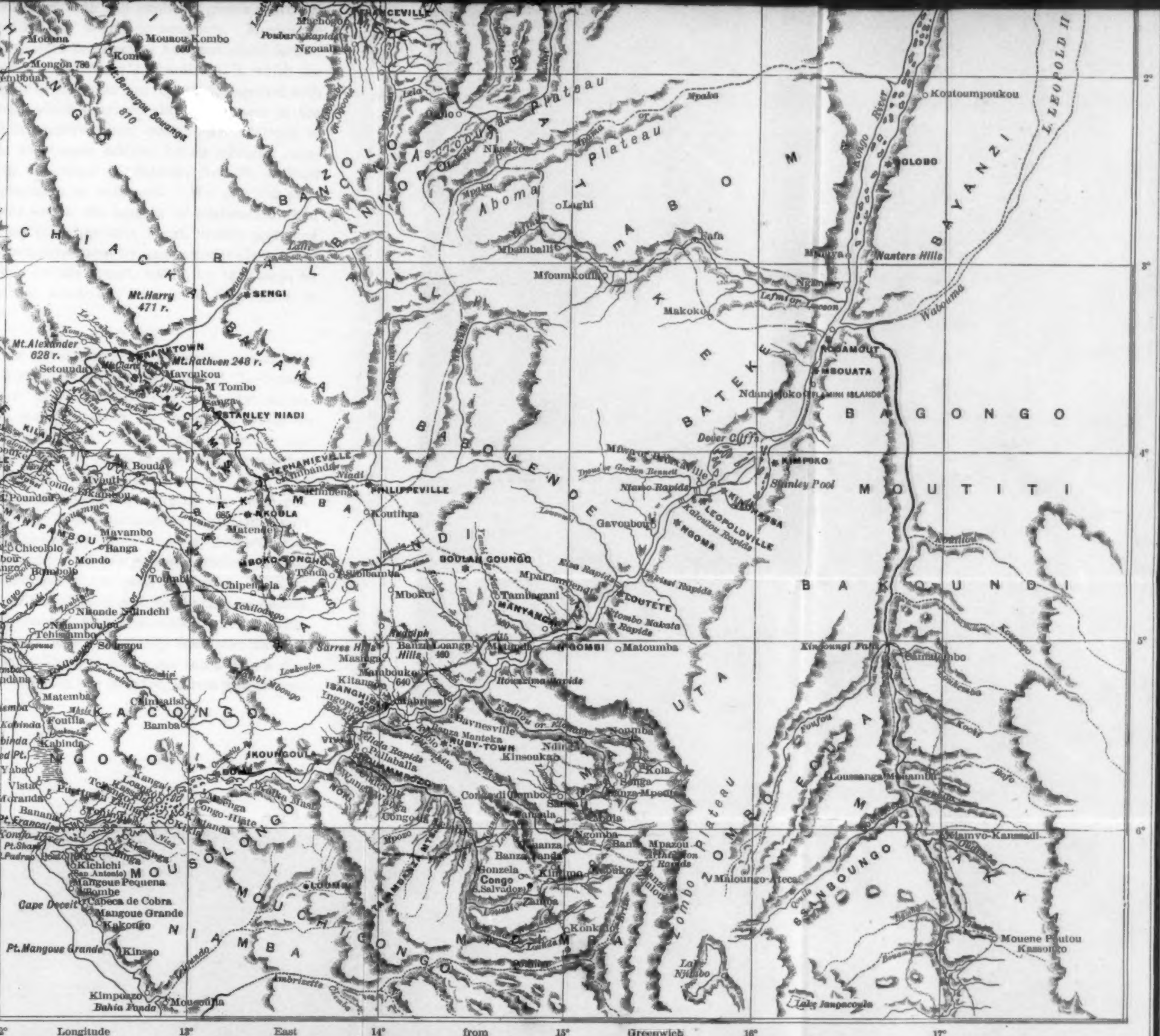


11°
East from
12°
Paris
13°
14°
15°
1°
2°
3°
4°
5°
6°
EQUATOR STATION
Ikengo
Ikebou
Ousinbi
Boutounou
MAHUMBA
Lewy Hills
LOUKOLELA
L. LEOPOLD II
Kontoumpoukou
BOLOBO
BAYANZI
Nanters Hills
Wabouma
Likona
Alima
APFOUROU
Mosenge
Kounya
Obanda
Souka
Mopoco
FRANCEVILLE
Ngounbsa
Poubara Rapids
Machogo
Kombo
Chebe
Malamba
Plateau
Mpaka
Aboma
Laghi
ABOMA
TEKE
Fafa
Mbamballi
Mfoumkouom
Makoko
Mpaka
Kouango
River
Ngampey
Lafini or Lecoon
NGAMOUT
MBOUATA
BATEKE
Dover Cliffs
KIMPOKO
Stanley Pool
KINCHASSA
LEOPOLDVILLE
Kalosiou Rapids
NGOMA
Ntamo Rapids
Gavoubou
B A G O N G O
M O U T I T I
B A K O U N D I
Kingoungi Falls
SENGI
Mt. Rathuen 248 r.
M Tombo
Mavoukou
STANLEY NIADI
STEPHANIEVILLE
PHILIPPEVILLE
Koutinga
NKOOLA
Matende
MBOKO SONGHO
Tchiloango
BOULAH GOUNGO
Mpakambendi
Tambagani
MANYANGA
LOUTETE
Ntombo Makata Rapids
NGOMBI
Matoumba
Mboko
Banza
Sarres Hills
Masinge
Kitanga
ISANGHILA
Mbambouko
Baynesville
Banza Manteka
RUBY-TOWN
Ndinga
Kinsoukab
VIVI
Yellala Rapids
Pallaballa
NOKI
IKOUNGOULA
BOMA
Congo-Haute
Mpazou
Bamba
Chipemhela
Toumba
Loussanga
Kimpalisi
Kola
Sanga
Mpozo
Banza Sande
Plateau
CONGO



MAP OF

The continuous line bordering the coast indicates the limits of shoal water.



AP OF THE DISTRICT ABOUT THE LOWER KONGO.

water.

AFTER CHAVANNE.

SCIENCE, January 2, 1885.